

R & D T H R E E Y E A R P L A N

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EXECUTIVE SUMMARY

The PM Europe R&D Three Year Plan 1992-1994 has been developed with the purpose of selecting those programs and priorities which will allow R&D to contribute in the most constructive fashion to the achievement of the goals of PM International during this Plan period. PMI's objectives for the 1992-1994 Plan period are as follows:

- * A minimum 6% annual growth rate in total unit volume;
- * Market share growth in all markets;
- * A minimum 20% annual growth in total Income from Operations and Net Income;
- * To further develop PM's international trademarks with the aim of making them global brands;
- * To be the low-cost producer within the industry without sacrificing quality leadership, while improving the Return on Management Investment;
- * To continue to maintain tight control of headcount in the Regional offices.

A review was made of our current status and the international business environment. This included consideration of the changing regulatory situations in the EEC Region and the rapid growth being experienced in the EEMA Region. As a result of this analysis the following five strategic goals were identified:

1. Support Operations' three year objectives in the areas of quality, cost, productivity and capacity.
2. Support the growth of the EEC and EEMA Region businesses in the short term.
3. Develop new and innovative products which address consumers' desires in the long term.
4. Identify, evaluate and develop technologies applicable to future products and processes.
5. Address external issues and requirements.

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Nine major programs were then identified which would support and further the realization of these strategic goals, as shown in the outline below. In several cases programs are listed as contributory to more than one of these goals. It should be noted that where programs exist in PM USA R&D which potentially impact on International objectives, PM Europe R&D programs have been established to be supportive and complementary. The strategic goals and the programs of R&D are projected to be as follows:

1. Quality, cost, productivity and capacity.

- Operations Support
- Reconstituted Tobacco
- Expanded Tobacco
- Product Development

2. Growth of businesses in the short term.

- Product Development
- Expanded Tobacco

3. Innovative products in the long term.

- Product Development
- New Product Technology
- Product Evaluation/Consumer Desires

4. Technologies for future products/processes.

- New Process Technology
- New Product Technology
- Product Development

5. External issues and requirements.

- Environmental Tobacco Smoke
- Pesticides, Ingredients & The Environment
- Product Development

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In the course of the analysis a number of issues were also identified which, without proper attention, could become serious obstacles to our continued efficient operation. These are issues which are persistent and not quickly resolvable, and the formulation of contingency plans to deal with them will be initiated.

These issues are:

1. The impact on resource allocation of potential headcount restrictions and space limitations.
2. Explosive future growth within the EEMA Region which may require unanticipated support resources;
3. An unknown regulatory environment across both Regions with respect to crop protection agents and ingredients, and to packaging from the standpoint of chemical additives and waste disposal;
4. A serious shortage in the pool of qualified technical talent available for recruitment;
5. The increasing need to provide more rapid training and development of a technical leadership base for the future through cross-training and management development.

The program objectives and the strategies for achieving them are outlined in the following pages for each of the nine major programs. In the Operations Support program will be found a collection of objectives since the program is quite diverse in scope, encompassing individual and group efforts of the R&D departments. Although the remaining programs have each been developed about a single objective, they also reflect the interdepartmental efforts in the strategies. For reference purposes, highlights of our present position in many of the program areas are appended to this document.

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R&D PLAN

Program: OPERATIONS SUPPORT

Issue: How do we enhance the quality of our products so as to eliminate, to the extent possible, manufacturing defects?

Business Risk: Failure to minimize visual quality defects and spoilage could result in consumer switching to competitor products.

Objective: Improve quality of PM products through improvement of materials and methods.

Strategies: Implement a total quality management program in all PM Europe factories, with a first goal of improving the quality assurance systems so as to be in compliance with ISO recommendations, and to have all factories certified according to ISO 9002.

Develop, together with Marketing, a program to address the consumers perception of quality and use it, along with consumer complaint data, to establish quality improvement programs.

Continue the qualification of new plug wrap/tipping paper combinations which improve machinability and will reduce consumer complaints related to filter attachment.

Develop, in conjunction with our suppliers, new cigarette papers with improved machinability on higher speed makers.

Assist PM Europe factories to improve filter consistency and machine efficiency while reducing material waste and manufacturing costs.

Critically evaluate the use of near infrared (NIR) methods as a production QA tool for the indication of any corrective measures necessary prior to the application of flavors and casings.

Assist in the evaluation and installation of foreign matter detection and removal systems.

Maintain state-of-the-art methods to measure temperature and humidity during tobacco storage and processing, and attempt to establish guidelines for the minimal impact of microbiological activity on subjective quality.

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Issue: How do we standardize our Quality Assurance functions at all locations where PM products are produced ?

Business Risk: Failure to provide QA technical support to all sites will result in varying degrees of quality for the same brands in different markets.

Objective: Provide and distribute quality assurance know-how throughout the EEC and EEMA Regions.

Strategies: Provide PM Europe affiliates and licensees with the technical support to improve the visual quality of their products.

Provide all PM Europe manufacturing sites with technical support in the areas of QA systems, organization, methods, equipment and procedures to meet PM quality standards.

Continue to implement and monitor the PM Infestation Control program in all licensee and affiliate locations.

Train all PM Europe tobacco suppliers on proper fumigation practices according to PM standard operating procedures for phosphine fumigations.

Monitor official testing laboratories and ensure that the testing of PM products is properly conducted.

Implement general quality assurance training programs for licensees and contract manufacturers.

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Issue: How do we ensure the consistent quality of our products which are produced in numerous factories ?

Business Risk: Failure to ensure consistency in product quality could erode the consumer image of our products.

Objective: Assure that quality objectives and quality perception, and the measurement and interpretation of QA data, are standardized throughout PM Europe.

Strategies: Finalize new sampling and acceptance procedures for ingredients, filter additives, adhesives and inks.

Complete the revision of packaging material specifications.

Establish general specifications for filter tows.

Continue the efforts to introduce concentrated base flavors in Marlboro production in order to realize cost savings.

Continue to approach standardization of QA methods and procedures through expert working groups in the areas of incoming materials, primary QA, secondary QA, smoking laboratory and panels.

Improve the consistency of European B-panels through comparative testing.

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Issue: How do we ensure that all of our products conform to PM quality standards and meet regulatory requirements ?

Business Risk: Failure to adequately control the quality of non-tobacco materials, tobaccos and products could result in losses of sales, losses during storage, and possible penalties for mislabeling.

Objective: Assure that all PM products conform to PM quality standards and regulatory requirements.

Strategies: Introduce the new visual quality audit, prepared in collaboration with PM USA, in all affiliates and licensees.

Establish a yearly vendor rating based on delivered quality, purchasing aspects and vendor audits.

Audit PM and competitor products in the Regions in order to monitor trends and provide data to support new product development and introductions.

Monitor PM products in the Regions in order to assure that they will comply with PM specifications.

Review the CIR reporting system to see if strategic information can be condensed and highlighted for use by R&D, Leaf, Marketing, and management.

Monitor sufficient numbers of tobacco lots to ensure that all PM Europe blends will result in cigarettes meeting the tar/nicotine delivery specifications.

Introduce the new ISO norms for cigarette smoking analysis in the three European PM smoking laboratories.

Coordinate a program with Engineering and the factories to identify and implement improvements in procedures for the control and measurement of filter weight, plasticizer application level and firmness.

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Issue: How does PM Europe meet its volume projections with the limited production capacity available ?

Business Risk: Failure to address this issue could result in severe limits in our ability to meet market demands for our products.

Objective: Implement a program which adequately addresses capacity requirements.

Strategies: Assist in the selection, qualification and evaluation programs for new primary equipment and in the definition of process parameters.

Assist in the design, start-up and qualification of primary extensions and new primaries.

Evaluate the total blend sieving and cutter bypass in the PM Australia primary and develop recommendations for Europe.

Perform project reviews, establish recommendations for process improvements, and provide assistance and consulting service to licensees.

Issue: How do we ensure consistent and optimal quality of our blend component processing and finished cut filler ?

Business Risk: Failure to standardize our tobacco feedstocks could result in undesired variations in our subjective product quality.

Objective: Develop and implement programs focused on standardization of primary processes and tobacco materials.

Strategies: Maintain and update the PM Europe Primary Information manual, complete the factory comparisons and develop general primary guidelines.

Evaluate and make recommendations to further improve specific process unit operations of the affiliates and licensees.

Standardize, to the maximum extent possible, processes and unit operations when qualifying new or modified equipment.

Coordinate the utilization of good manufacturing practices (GMP) for PM Europe.

Identify the impact of primary processing changes on product quality through physical analysis of tobacco (filling power, shred size).

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Program: RECONSTITUTED TOBACCO

Issue: How do we ensure sufficient and interchangeable quantities of sheet materials for our future needs ?

Business Risk: Failure to address this issue could result in undesired changes in subjective product quality and lack of product standardization.

Objective: Define, in collaboration with PM Europe Leaf and PM USA, our company's worldwide sheet requirements versus capacities and develop alternate sheet products.

Strategies: Optimize the future utilization of OTMs with respect to all existing and new reconstitution processes.

Assist in the PM USA development of the cast leaf process and qualify European feedstock for this process.

Provide support for a pre-engineering study concerning the potential new BL facility in Europe (Greenfield study).

Evaluate and qualify, in conjunction with PM USA and PM Europe Leaf Departments, alternate sheet materials to those made in PM USA.

Assist Bandtabak Malchin (BTM) in their sheet quality improvement program.

Complete the humectant level standardization program for PM Europe.

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Program: EXPANDED TOBACCO

Issue: How do we ensure sufficient and interchangeable quantities of expanded tobacco for our future needs while improving the safety of the operations ?

Business Risk: Failure to address this issue could result in undesired changes in subjective product quality, lack of product standardization, and substandard processing environments.

Objective: Implement process and product quality improvements, standardization and adequate safety procedures in the four European ET facilities.

Strategies: Complete the ET Pan Europe report, and the ET section of the Primary Information manual, and implement the follow-up for plant optimization and standardization.

Establish and implement ET product specifications and process targets.

Qualify and evaluate equipment and blends, including the new ET feedstock processing line at FTR in Onnens and the new ET installation at BOZ.

Assist the facilities in the implementation of process improvements and blend modifications.

Develop and implement the NET evaluation and qualification program for PM Europe.

Assist in the follow-up to the Kellogg hazard review, the metallurgical investigation, and in general safety matters.

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Program: **PRODUCT DEVELOPMENT**

Issue: How do we reposition our current brands and introduce brand extensions and new brands to assure coverage of the important market segments ?

Business Risk: Failure to correctly position our brand families could result in missed market opportunities and loss of advantage from our current competitive position.

Objective: Modify existing products and develop new products to meet Marketing, productivity, standardization and/or regulatory requirements.

Strategies: Support actively all programs aimed at monitoring consumer perceived product performance of our key brand families and initiate, as needed, product modification programs in order to ensure our competitive advantage in the market-place.

Ensure product standardization within brand families and clear differentiation of product performance between brand families based on business objectives.

Improve and maintain our computerized project management system in order to optimize the speed and flexibility of the product development process.

Develop and apply a screening system that can be used to select the most attractive opportunities from our inventory of all new and innovative product ideas generated within the company.

Develop and implement a program to reduce tar deliveries of all of our brands (if needed) to ensure compliance with the 1993 EEC tar ceiling regulations.

Develop a long-term plan for the further reduction of the tar deliveries of our brands so as to comply with the 1998 EEC tar ceiling regulations, including the evaluation of emerging technologies for low tar/high taste.

Implement programs aimed at substituting important product components such as:

- DIET by NET
- RL-TC ex PM USA by RL ex LTR
- MPEG by Triacetin
- Licorice by Flavor Concentrate

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Program: NEW PRODUCT TECHNOLOGY

Issue: How do we identify and evaluate new product technology which will allow us to be a leader in innovative product concepts, and will enable us to respond to competitive challenges ?

Business Risk: Failure to maintain capabilities for innovative product introductions could result in the inability to participate in new and unique market opportunities.

Objective: Increase the effectiveness in technology management in order to improve product innovation, and create new and innovative ideas/concepts for the cigarette market.

Strategies: Monitor technologies developed within and outside of the corporation on a worldwide basis to identify potential areas of application and maintain a technology "storehouse".

Strengthen our know-how in the area of technology-product relationships in order to:

- a) Improve our mathematical prediction models to enable rapid achievement of product objectives for mainstream and sidestream smoke deliveries;
- b) Select and assess key technologies for the development of innovative products.

Develop specifically the following selected technologies to the stage of industrial application:

- Total Blend Expansion
- Tobacco Sheet Filter
- CA-Web Filter
- Tobacco Sheet Cigarette Wrapper
- Dual Cigarette Wrapper
- Tobacco Extract Flavors
- Concentric Tobacco Rod

Evaluate new filter construction concepts to determine whether smoke exit flow patterns can be used as a tool to influence perceived subjective quality.

Evaluate new filter construction concepts which might provide enhanced control of gas phase mainstream smoke chemistry.

Assess technologies available for the enzymatic removal of specific tobacco components which might lead to a more desirable mainstream and sidestream smoke.

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Determine the effect of cigarette construction parameters and filler additives on total sidestream smoke yield.

Identify naturally occurring materials in certain tobaccos which have preservative or pesticidal properties and might be acceptable alternatives to currently used control agents.

Explore modern genetic engineering techniques which have the potential to impart preservative or pesticidal properties to tobacco without leaving undesirable residues.

Program: **PRODUCT EVALUATION/CONSUMER DESIRES**

Issue: How do we build our knowledge of consumer desires to enable us to develop market-led products ?

Business Risk: Failure to understand performance-driven market dynamics could result in loss of market opportunities and loss of existing market shares to the competition.

Objective: Develop our understanding of consumer perceived product performance.

Strategies: Improve and maintain our internal descriptive panel in order to build a consistent data base on subjective product attributes of competitive products as well as of cigarette prototypes.

Improve and maintain, in collaboration with Market Research, the computerized model in which market dynamics are correlated with measurable and subjective product attributes.

Monitor the evolution of the key competitive products by making optimum use of our current cigarette information activities and ensure rapid awareness on competitors new product introductions.

Advise Market Research on qualitative and quantitative design and content of consumer test questionnaires in order to improve our interpretation and understanding of consumer test results.

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Program: NEW PROCESS TECHNOLOGY

Issue: How do we identify and evaluate new process technology which will allow us to maintain product quality leadership in the industry ?

Business Risk: Failure to update our process technology could result in erosion of competitive quality and in lack of flexibility and interchangeability in component utilization.

Objective: Develop, evaluate and implement new processing technologies for potential application in PM facilities.

Strategies: Qualify and evaluate the direct cylinder conditioning unit including casing application in the new ET feedstock processing line at FTR in Onnens.

Implement the evaluation program of the new Hauni HT tunnel prior to the dryer in the Miniprimary.

Complete the evaluation of the program for cut filler recovery from winnowers.

Monitor and assist in the New Primary Process program initiated in PM USA.

Identify technologies in industries similar to ours and intensify contacts with equipment suppliers to keep abreast of new developments.

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Program: ENVIRONMENTAL TOBACCO SMOKE

Issue: How do we confront attacks on PM and our industry based on presumed health risks of environmental tobacco smoke ?

Business Risk: Failure to maintain technological awareness could result in restrictive laws against smoking at work and in public places, and in increased risk of product liability action.

Objective: Assess the impact of environmental tobacco smoke (ETS) on indoor air quality.

Strategies: Conduct investigations on the potential formation of undesirable components in aging ETS and assess how they might be controlled.

Investigate the influence of household furnishings on the aging and accumulation of ETS.

Participate in industry programs to develop and recommend analytical methodology for use by industry and government.

Develop and use portable monitoring equipment to evaluate indoor air quality in public structures and transportation.

Evaluate methods proposed in the literature for chemical markers intended to indicate exposure to environmental tobacco smoke.

Assure that sidestream yields of PM products are in compliance with future internal guidelines and provide market-place surveys.

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Program: PESTICIDES, INGREDIENTS & THE ENVIRONMENT

Issue: How do we anticipate and satisfy all the regulatory requirements arising from environmental pressures on our products ?

Business Risk: Failure to respond could result in nonshipment of finished products, product recall from the marketplace, loss of market shares, and civil and criminal liability for local operations management.

Objective: Ensure that blend components, nontobacco materials, finished products and packaging comply with existing and future legal requirements in both the EEC and EEMA Regions.

Strategies: Monitor pesticide residues on incoming tobacco lots, finished products and potential leaf purchases with a frequency based on legal requirements and sound statistical practices.

Monitor ingredient levels in cigarette, packaging and manufacturing materials either currently being used or being evaluated for qualification to assure compliance with legal requirements in the PM Europe Regions.

Extend analytical capabilities for pesticides and ingredients for which legislation is being proposed or which are considered undesirable in, or in contact with, our products.

Develop rapid screening methods for pesticides which will allow a significant reduction in workload while maintaining a high level of reliability.

Establish a database for analytical methods and reported results, possibly in conjunction with other PM companies, which would allow systematic reevaluation of the monitoring levels which are necessary to maintain due diligence.

Identify areas of processing and packaging which may pose environmental impact problems in the future, and initiate plans for technological solutions.

Identify regulatory issues of corporate concern in the EEC and EEMA Regions, advise management on their technical and legal ramifications, and represent the industry's interests through interactive programs with scientific and norm associations.

Contribute, through contact with suppliers and governmental authorities, to the registration of PM recommended infestation control products.

Develop, together with suppliers, new adhesives for cigarettes and packaging materials which are based on naturally occurring substances.

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R&D PRESENT POSITION

Program: OPERATIONS SUPPORT

Objective: Improve quality of PM products through improvement of materials and methods.

Highlights: A standard format is being developed for the reporting of consumer complaints.

New porous plug wraps have been developed jointly with Schoeller & Hoesch and Dexter, and testing for improved machinability will be completed in early 1992.

Machinability improvements for cigarette papers were achieved in a joint effort with Wattens and de Mauduit.

A near infrared (NIR) method has been developed for the control of eight flavors and casings prior to application, and procedures to enable use of the method by QA are now being established.

A ripper screening cost study was completed.

A comparison of packing density and OV between machine threshed and hand stripped tobacco was made for Malawi flue-cured and burley.

The first foreign material detection and removal system is being placed in PMG Berlin.

The microbiological and chemical states of burley tobacco, before and after drying treatment, are currently under evaluation.

It was shown that dipicolinic acid, which is released subsequent to the germination of *Bacillus* spores on tobacco, can be a major source of off-taste, and an analytical method for its detection on tobacco was developed.

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Objective: Provide and distribute quality assurance know-how throughout the EEC and EEMA Regions.

Highlights: Technical assistance in the areas of quality systems (organization) and visual quality was provided, and/or audits of quality assurance functions were performed in Italy, Hungary, Poland, Turkey and South America.

The PM Infestation Control program was reviewed on site with all affiliates and 15 licensees.

Training on the PM standard operating procedures for fumigations was given to 35 leaf suppliers.

Through collaborative studies it was assured that governmental laboratories correctly tested and accepted PM products in different markets.

A general presentation on quality assurance was prepared, covering the PM quality philosophy, the quality assurance organization and the tasks of the individual departments.

A training course, "Statistics in QA Laboratories," was organized for all PME affiliates.

Objective: Assure that quality objectives and quality perception, and the measurement and interpretation of QA data, are standardized throughout PM Europe.

Highlights: An incoming inspection procedure for tobacco ingredients and filter additives was established and is currently under review in the Legal Department.

Methods for the analysis of powdered ingredients have been elaborated, based on time-saving near infrared technology.

A program for the routine analysis of solvents in printed materials has been established and implemented.

Industrial trials with concentrated base flavors (Marlboro), aiming at cost reductions and standardization with PM-USA, have been carried out in BOZ, Berlin and FTR.

Further standardization of QA methodology and procedures was achieved through the established working groups in the areas of incoming inspection, primary QA, secondary QA, smoking laboratory and panels.

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A study addressing the feasibility of a single smoking laboratory for PM Europe was completed.

The DDD (determination of differences) method used by all the European B-panels was reviewed and the results of inter-affiliate collaborative tests improved accordingly.

A B-panel was set up in Modena.

Objective: Assure that all PM products conform to PM quality standards and regulatory requirements.

Highlights: The new visual quality audit system was introduced in R&D QA and was used to evaluate the products of all affiliates, new monthly and quarterly reporting systems were developed, and training of affiliates and licensees was begun.

Together with Purchasing, an overall rating of suppliers was established and published covering the period July, 1990 to June, 1991.

PM and competitor products continued to be closely monitored, with special attention given to the Italian market in view of the introduction of printed numbers.

Modifications of equipment and methods are being made in the smoking laboratory to accomodate the new ISO norms for cigarette smoke analysis, and correlations with the old norms will be established.

Objective: Implement a program which adequately addresses capacity requirements.

Highlights: Support was provided for the start-up and qualification of two new Legg dryers in PMG Berlin.

The start-up and qualification of two new P&S burley dryers in PMG Berlin is in progress.

Support for the FTR primary improvement program is being provided.

Assistance is being provided to both PM Europe Regions on the design of primary and stem operations.

An evaluation was made of BBS processing at PMG Munich.

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Objective: Develop and implement programs focused on standardization of primary processes and tobacco materials.

Highlights: The Primary Information manual was completed for all four PM affiliates, an update was issued for BOZ and the Berlin update is in progress.

The primary process quality program is being transferred to QA, standardization of methods has been initiated, and the central analysis of cut rag is in progress.

An evaluation of Comas stem was conducted for MTI (Italy).

Assistance is being provided for the qualification of a new stem line in Poland.

The PMG Munich burley dryer standardization and capacity increase program was completed.

The automation of physical testing in the Process Development laboratory is in progress.

Program: RECONSTITUTED TOBACCO

Objective: Define, in collaboration with PM Europe Leaf and PM USA, our company's worldwide sheet requirements versus capacities and develop alternate sheet products.

Highlights: An evaluation of global PM sheet requirements and capacities has been initiated.

The European OTM situation was evaluated and a classification system was established for factory generated class tobaccos as feedstock for recon processing.

A program was initiated to evaluate the cast leaf product for potential use in Europe.

First trials were completed in an attempt to reproduce an RL-TC sheet at LTR.

Technical assistance was provided to Bandtabak Malchin (BTM) for process, product and methods improvements.

Reductions in the humectant level of the BTM sheet were achieved to meet German regulatory requirements.

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Program: EXPANDED TOBACCO

Objective: Implement process and product quality improvements, standardization and adequate safety procedures in the four European ET facilities.

Highlights: Plant optimization and standardization of the European ET facilities was continued.

A program was established for the evaluation of a new ET feedstock processing line, containing DCC equipment, at FTR in Onnens.

The production of ET for Diana was transferred from PMG Munich to MTI Bologna and on-site assistance was provided for the qualification trials and quality follow-up.

Various blend expansion trials were successfully conducted at FTR in Onnens for requesters including the Swedish Tobacco Group and China.

Trials of Total Blend Expansion were conducted to support evaluation of the technology for new product development.

The New Expanded Tobacco (NET) program was initiated and will continue for the evaluation of European ET blends.

Assistance was provided to facilities to solve problems of the process gas, CO₂ liquid and recovery systems.

A safety hazard review program was started and is continuing in collaboration with PM USA.

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Program: **PRODUCT DEVELOPMENT**

Objective: Modify existing products and develop new products to meet Marketing, productivity, standardization and/or regulatory requirements.

Highlights: A reduced cost L&M full flavor to be sold in Belgium has been developed and is presently being tested among consumers.

Eight existing products now sold in Italy, including Muratti, Philip Morris Multifilter, Diana, Mercedes, and Philip Morris Lights Ultra Slim, have been modified in order to reduce tar and nicotine deliveries prior to the implementation of the labeling directives.

Marlboro and L&M products manufactured and sold in Eastern Europe have been standardized in terms of blend, flavor system and construction in order to be as close as possible to the Pan-Europe standard.

All PM products manufactured under licence by ATO in Finland have undergone an increase in length from 79 mm to 84 mm.

A new Muratti Lights with a concentric filter and a 4 mg Tar delivery has been developed and launched on the Swiss market.

Belmont Ultra with a concentric filter and a 1 mg Tar delivery has been introduced in Finland.

Marlboro Lights KS and 100's delivering 6 and 8 mg Tar respectively have been developed and may be introduced in the UK prior to the implementation of the labeling directives.

The development of a Multifilter Super Lights for Italy, delivering 3 mg Tar, was completed.

A new Ultra-Slim cigarette, delivering 4 mg Tar, has been developed and will be introduced in Italy early in 1992 as a Multifilter line extension.

A cigarillo type product with a performance similar to a full flavor cigarette has been developed and will be consumer tested in Germany during fall 1991.

A new low cost American Blend product has been developed and introduced, using the Karo Filter trademark, in the former East Germany.

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Program: NEW PRODUCT TECHNOLOGY

Objective: Increase the effectiveness in technology management in order to improve product innovation, and create new and innovative ideas/concepts for the cigarette market.

Highlights: A study was completed demonstrating significant tobacco weight reductions, at constant firmness, through substantial increases in tobacco cut-width.

A very acceptable Marlboro product was developed using 500 mg of a fully cased and partially expanded blend.

A cigarette with a flat puff-by-puff profile was developed, using tube-in-tow technology, which did not show any significant product advantages in consumer testing.

The existing cigarette simulation model has been further improved by introducing the possibility of predicting the impact of combined and concentric filters on overall product performance.

Studies on the influence on sidestream smoke yields of modifications in cigarette design and/or materials are being completed.

The influence of tobacco wrappers, replacing cigarette paper, on mainstream and sidestream smoke deliveries has been studied, and the results are now being applied to the development of reduced sidestream cigarettes.

An extensive study was completed on the influence of key product design parameters on the enhanced performance of Ultra Low Tar products, and the main findings are being implemented in the Philip Morris Ultra improvement program.

A fractionation procedure was developed to isolate three components from oriental tobacco which might have biocidal activity and prevent tobacco spoilage, and testing of the inhibitory activity of these fractions is underway.

Literature studies, participation in international conferences, and visits to biotechnology research centers have been initiated in order to assess the current state of genetic engineering techniques for tobacco pest control.

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Program: PRODUCT EVALUATION/CONSUMER DESIRES

Objective: Develop our understanding of consumer perceived product performance.

Highlights: In order to improve our understanding and interpretation of consumer test results, Product Development and Marketing Research have started the following program to redesign the standard questionnaire used in product tests:

- First half of 1991: qualitative studies on vocabulary conducted in Germany (West and East), Holland and Spain.
- Second half of 1991: same studies will be conducted in Belgium and Switzerland.
- By end 1991: a new standard questionnaire will be designed jointly with PMI Marketing Research Management with quantitative studies to validate the new concept to be conducted beginning 1992 in the above countries.

The major Blind Product Testing programs supported were:

- Marlboro Monitoring Program in the major EEC and EEMA markets (France, Holland, Belgium, Germany, Greece, Switzerland, Finland).
- Monitoring of Marlboro Lights (France, Switzerland), Philip Morris Super Lights (France, Belgium) and Merit (Switzerland).

The consistency and accuracy of our internal descriptive panel have been improved by the introduction of a "Monitor" cigarette which is smoked at the beginning of each session in order to calibrate the panelists prior to the profiling of the products, and a profiles data base, Sensory Profile Analysis (SPA), of competitive products as well as of cigarette prototypes has been created.

The development of the computerized model for correlating market dynamics with measurable and subjective properties has been completed, the model's evaluation and optimization are in progress, and the selection of competitive products which are to be analyzed and profiled has been finalized.

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Program: NEW PROCESS TECHNOLOGY

Objective: Develop, evaluate and implement new processing technologies for potential application in PM facilities.

Highlights: The HT tunnel prior to the cut filler dryer in the Miniprimary was ordered and is scheduled for installation in September, 1991.

Trials were successfully conducted at Hauni in Hamburg to evaluate the recovery of cut filler from winnower stems.

Members of the technical staff participated in the New Primary Process Technology Meeting in Richmond.

The evaluation of the Comas puffing process was completed for stems and cut filler.

Discussions have been held with several equipment suppliers to explore technologies for primary improvements.

PM Europe R&D hosted the 33rd Tobacco Colloquium in Interlaken, with participants from 17 companies and 18 presentations being given.

Program: ENVIRONMENTAL TOBACCO SMOKE

Objective: Assess the impact of environmental tobacco smoke (ETS) on indoor air quality.

Highlights: Nearly 150 compounds collected from extinguished cigarette butts and profiled as odorous by headspace GC-sniffing have been identified by GC-MS-GC-FTIR.

A small smoking chamber has been constructed in which the kinetics and mechanisms of ETS aging can be studied under controlled conditions.

Methods for ETS monitoring continue to be assessed through collaborative studies within the industry.

Concepts for measuring ETS exposure are critically and continually being evaluated.

The determination of sidestream smoke visibility and yields of carbon monoxide, particulate matter and nicotine are routinely performed, and the monitoring of additional parameters is being assessed.

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Program: PESTICIDES, INGREDIENTS & THE ENVIRONMENT

Objective: Ensure that blend components, nontobacco materials, finished products and packaging comply with existing and future legal requirements in both the EEC and EEMA Regions.

Highlights: Tobacco lots used by PM Germany and selected products from EEC countries were screened on a regular basis for pesticide residues and humectants, and the leading brands in several EEC countries were surveyed twice yearly.

Analytical support is being given to Packaging Development EEC and EEMA for the qualification of new materials such as water-based inks and varnishes.

The headspace-GC method for analysis of residual solvents on printed packaging materials has been set up in QA laboratories.

In conjunction with PM USA R&D, methods are being developed for the analysis of seven additional ingredients which will be forbidden in our products according to proposed German legislation.

Commercially available antibody-based kits are being evaluated to determine whether immunoassay technology could be a useful screening tool in tobacco pesticide analysis.

Significant reductions in running time have been gained by improving methods for checking flavor and tobacco sheet conformity to legal requirements.

PM Europe established a leading role in CORESTA for the development of a measurement method for firmness while smoking, and in the tobacco subgroup of the Swiss norm association for the new ISO norms for cigarette smoke analysis.

In conjunction with Packaging Services, a program was established for the improvement and standardization of packaging adhesives.

Joint work with Henkel and National Starch has resulted in the preliminary formulation of a subjectively acceptable, naturally based sideseam and tipping adhesive, and further improvements are in progress to address machinability issues.

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